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ECONOMIC ANALYSIS
OF
INTERSTATE HIGHWAY ROUTINGS

FROM

FALLON
TO
GLENDIVE

PREPARED BY

PLANNING SURVEY DIVISION

AND

INTERSTATE DIVISION

OF

MONTANA STATE HIGHWAY COMMISSION

IN COOPERATION WITH

U. S. DEPARTMENT OF COMMERCE

BUREAU OF PUBLIC ROADS

NOV. 9, 1959

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STATE OF MONTANA
STATE HIGHWAY COMMISSION

PLAN AND PROFILE OF PROPOSED
FALLON - GLENDIVE
ALTERNATE ROUTES

I-IG-94-5(2)171, I-94-5(3)182
I-94-6(3)191 & I-IG-94-6(1)208

LENGTH		
	NORTH ROUTE	35.097 MILES
	SOUTH ROUTE	37.459 MILES

SCALES

HORIZONTAL: 1 Inch= Feet
VERTICAL: 1 Inch= Feet
CROSS SECTIONS—HOR. & VERT.: 1 Inch= Feet
REDUCTION PRINTS ½ ORIGINAL SCALE

FED. ROAD DIV. NO.	STATE		FISCAL YEAR	SHEET NO.	TOTAL SHEETS
	MONT				

STATE NUMBER ____________
PLANS COMPLETED ____________
CONTRACT COMPLETED ____________

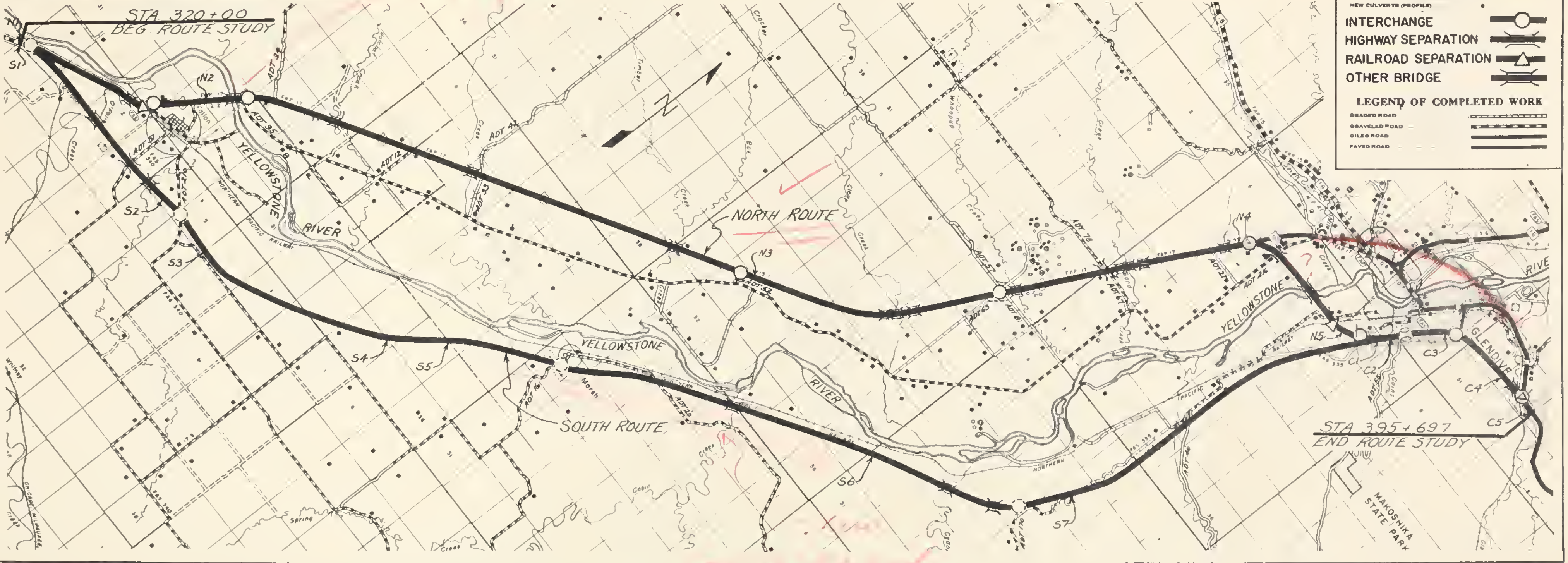
ROUTE LOCATION STUDY

CONVENTIONAL SIGNS

- STATE AND NATIONAL LINE
- COUNTY LINE
- CITY, VILLAGE OR BOROUGH LINE
- TOWNSHIP LINE
- SECTION LINE
- RESERVATION LINE
- FENCE LINE
- GUARD RAIL
- UNFENCED PROPERTY
- RIGHT OF WAY LINE
- RIGHT OF WAY LINE FENCED
- TRAVELED WAY
- RAILROADS
- RETAINING WALLS
- BASE OR SURVEY LINE
- LEVEE
- CULVERTS IN PLACE (PLAN)
- NEW CULVERTS (PLAN)
- NEW CULVERTS (PROFILE)
- INTERCHANGE
- HIGHWAY SEPARATION
- RAILROAD SEPARATION
- OTHER BRIDGE

LEGEND OF COMPLETED WORK

- GRADED ROAD
- GRAVELED ROAD
- OILED ROAD
- PAVED ROAD



ECONOMIC ANALYSIS OF ROUTINGS OF
INTERSTATE HIGHWAY NO. 94
BETWEEN FALLON AND GLENDIVE

November 9, 1959

FOREWORD

An economic analysis of this type is prepared for the purpose of presenting factual data which may be used in determining the most favorable highway routing where more than one location is under consideration. Although the analysis deals with many features of highway location, its principal function is to evaluate those considerations which can be reduced to monetary terms. These considerations include the cost of constructing the alternate routes, the cost of maintaining each route, and the cost which will be incurred by the highway user in traveling on each route.

Since the cheapest route to construct and maintain does not always provide the best service to the highway user, it is also necessary to consider vehicular operating costs in determining the route which is of greatest overall benefit. Likewise, it is also necessary to consider the general highway transportation situation in the area involved rather than to analyze only a single route or a pair of competing routes.

Federal and State funds for the support of highways are obtained almost entirely from highway-user taxes; consequently, the most favorable highway location, from the standpoint of the highway-user, would be the route that has the lowest overall cost when all construction, maintenance and vehicular operating costs are taken into consideration. The situation may also be reviewed in light of the relationship between the capital costs of construction and maintenance and the value of the savings to the motorist in reduced operating costs on the new highway facilities. This relationship is reflected in a benefit-cost ratio which favors the route having the greatest return in operating costs savings in relation to the money invested in construction and maintenance.

DESCRIPTION OF THE PROBLEM

A previous analysis of alternate routings in the vicinity of Glendive showed that a location along the southeast edge of the city would provide the best service to traffic and would also be preferable from a construction standpoint. This matter was discussed at a public hearing at Glendive on March 10, 1959.

This routing was also supported by the local officials and other persons attending the hearing; however, they also recommended that the rural routing

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between Glendive and Fallon be continued on the southeast side of the Yellowstone River throughout the entire distance between these two places. The following points were presented as principal considerations favoring the southside location:

1. An Interstate highway on this side of the river would serve the through traffic, would serve a number of local residents, and would serve a large volume of traffic to the oil fields southwest of Glendive.

2. The present road through this area is of a very low standard and is totally inadequate to serve the transportation needs and the triffic volumes of the area.

3. The county and the principal oil company have spent substantial amounts on the road but the cost of the remaining construction is beyond the means of the county.

4. Substantial amounts of oil royalties have been received by the State and the Federal government from these oil fields, and it was felt that some of this royalty money should be returned to the area in the form of road improvement.

5. The southside location would eliminate the need for two major bridges and would provide a better highway from a defense standpoint. It would also eliminate the need for a separate FAS route for the greatest part of the distance to the oil fields.

These are all valid points in favor of the South Route, but other considerations, which were mentioned in part at the hearing, are described below:

1 The present highway on the north side of the river was built in 1950 to relatively high standards. It is located on high ground with practically straight alignment. Although it is somewhat below Interstate System standards, the highway will provide adequate service to the moderate traffic volumes for many years. The reconstruction of this section of highway would normally be deferred until the end of the Interstate construction program.

2. It is located adjacent to a large irrigated area on the north side of the Yellowstone River. Essential service

is provided to a substantial volume of local traffic originating in the vicinity.

3. The eventual reconstruction of the present highway could be accomplished on the same line with a requirement for only a small amount of additional right-of-way. Such right-of-way should be inexpensive.

4. The new section of four-lane highway west of Glendive was built in at least partial anticipation that it would serve Interstate System traffic to Glendive. The diversion of a substantial volume of through traffic to the South Route location would detract from the need for a four-lane facility west of Glendive with the resultant uneconomic investment. The North Route would also provide better connections with Montana Highways 16 and 20S. It would also retain the present connection to the north side of Glendive in addition to providing new access points on the south side of the city.

5. Assuming that Federal and State finances will support a $27,500,000 annual Interstate construction program in the future, it appears that eight years would be required to complete the construction of the entire section of highway from Fallon to Glendive. This 8 year period is based on the assumption that all money available to Financial District No. 4 would be spent on this section of highway, and the 8 year period would apply to either of the routes.

   The early construction of the first 12 miles west of Glendive on the South Route could be justified on the basis of traffic service to the oil fields. The remaining 25 miles to Fallon would be of little value until it could be built through to Fallon and could serve the through traffic that would divert from the present highway.

   On the North Route a section of new highway could achieve full usage as soon as it was completed. The same condition of full usage would apply to each succeeding section, and there would not be the pressing need to complete the entire highway from Fallon to Glendive as rapidly as possible. This procedure would permit the reconstruction of other sections of highway within the financial district as the need developed.

6. If the South Route were to be built, it would be necessary to maintain separate highways on each side of the river

with total mileage equal to about 72 miles. Retention of the Interstate highway on the north side of the river would involve the maintenance of about 35 miles there and about 16 miles of Secondary System road to serve the oil fields and the local traffic on the south side of the river.

In preparation of this analysis, the following points have been considered:

1. If the Interstate System highway is to be located on the north side of the river, it will also be necessary to construct adequate facilities on the south side of the river to serve the traffic there which is now operating on inadequate county roads. This would involve construction to oiled standards of the 16 miles of FAS Route 335 from Glendive towards the oil fields.

2. If the Interstate System highway is to be located on the south side of the river, the alignment will replace only 12 miles of FAS Route 335. It will be necessary to construct to oiled standards the remaining 4 miles of this road. It will also be necessary to maintain the existing highway on the north side of the river.

3. It has been explained that the existing highway on the north side of the river is of recent construction and of high standards that would permit the full usage of the highway for many years in the future. This postponement of reconstruction and full utilization of the present investment would ordinarily grant a significant advantage to the north side Interstate location. In comparison, the selection of the south side Interstate location would dictate that construction be started as soon as possible in order to serve the traffic there, and particularly the oil field traffic, that is now operating over inadequate roads. In the interest of equal treatment, this advantage to the North Route is being disregarded, and construction costs for each route have been computed on the assumption that they would be constructed immediately throughout the entire length from Fallon to Glendive.

DESCRIPTION OF ROUTES

Although the two routes are located on the northwest and southeast sides of the Yellowstone River, they will be referred to as the North Route and the South Route for easy identification.

The North Route starts at a point about 3 miles west of Fallon and follows the present highway to a point about 4 miles west of Glendive. At this point, the route leaves the present highway in order to avoid the developed portion of the city and crosses the Yellowstone River and the Northern Pacific Railway on a line south of the city. It then follows along the southeast edge of the city in the vicinity of Rosser Avenue. In the vicinity of Graveyard Coulee, it veers in an easterly direction and joins the new highway construction at a point about 3 miles east of Glendive. The location of the route and principal features are shown on the enclosed area map and aerial photographs. The total length of the route is 35.1 miles.

The following principal advantages are noted for this route:

1. It is about 2.4 miles shorter than the South Route. This shorter distance is reflected in lower roadway construction costs and savings in travel distance to the motorists.
2. Since it follows the present highway, the existing traffic patterns will be preserved, and there will be a minimum of disruption of present development.
3. Additional right-of-way requirements would be held to a minimum and most of the present alignment and grade could be preserved in the reconstruction process.
4. An entry into the north side of the city and connections to Montana Highways 16 and 20S would be retained via the present highway. This feature would protect the present investment in commercial service facilities on the north side of the river.
5. Gradient and rise and fall are inconsequential on the highway on the north side of the river.

Disadvantages include:

1. The proposed river crossing site south of Glendive is not too favorable. The new location will require additional length for the structure. One channel of the river will be blocked and the water will have to be diverted to the main channel. Ice jams could be a problem, and extensive riprap will be necessary.
2. The North Route will involve two major structures over the Yellowstone River and two railroad separation structures.

The South Route starts at the same point of common terminus west of Fallon and follows along the edge of an irrigated area in this vicinity. East of Fallon the route climbs to the top of a bench where dryland farming is practiced. A portion of the farmland will be required for right-of-way purposes. The route then descends into the river valley near Marsh. It then follows on a line parallel to the NP RR for a distance of about 6 miles where it connects to a relocated line for FAS Route 335. East of this point, it overlays a portion of the present county road and then veers to the south of this road. At a point near Glendive, it joins the same line as the North Route and follows this same line to the eastern terminus. The length is 37.5 miles.

In general, this route would be less desirable from a construction standpoint since it would be 2.4 miles longer, has considerably more rise and fall with steeper grades, and it is located through terrain where earthslides could become a problem. Although land damage is not extensive, there are some places where right-of-way requirements would affect present farming operations.

The route has the advantage, as mentioned before, that it would eliminate the need of constructing the major portion of the FAS highway in the area southwest of Glendive. It would also eliminate the need for two bridges over the Yellowstone River and two railroad overpasses.

CONSTRUCTION AND MAINTENANCE COSTS

The attached tables show the detailed construction costs by separate highway sections. It may be noted that the North Route is estimated to cost $11,384,000 whereas the South Route costs an estimated $10,932,000.

Because of the variation in service lifes of different items, it is necessary to reduce the total cost to an annual cost in order to make a direct comparison of the two routes. The following table shows the annual costs, based on the different service lives:

MONTANA
INTERSTATE ROUTE 101
SHEET 12 OF 13

ESTIMATED INTERSTATE CONSTRUCTION COSTS

COST ITEM	YEARS LIFE	NORTH ROUTE		SOUTH ROUTE	
		TOTAL COST	ANNUAL COST	TOTAL COST	ANNUAL COST
Right-of-way	50	$ 588,000	$ 11,760	$ 651,000	$ 13,020
Structures	50	4,566,000	91,320	1,699,000	33,980
Base & surface	20	2,242,000	112,100	2,704,000	135,200
Traffic services	20	270,000	13,500	320,000	16,000
Other items	40	3,718,000	92,950	5,558,000	138,950
TOTAL		$11,384,000	$321,630	$10,932,000	$ 337,150
AVERAGE LIFE		35.4 years		32.4 years	

The North Route has a longer estimated service life because of the higher proportion of costs in long-lived structures.

Several sections of highway on the South Route have grades running as high as 5 percent. Such excessive grades make it necessary that four-lane sections of highway be built in order to permit the faster-moving passenger cars to pass the slower-moving trucks. The extra amount of four-lane mileage and the additional length of the entire route increase the maintenance costs for the South Route. The details of computation are shown below:

	ESTIMATED MAINTENANCE COSTS	
	NORTH ROUTE	SOUTH ROUTE
Miles of 2-lane highway	31.213	26.850
Cost per mile	$1,500	$1,500
Annual maintenance cost	$46,820	$40,275
Miles of 4-lane highway	3.884	10.609
Cost per mile	$2,500	$2,500
Annual maintenance cost	$9,710	$26,523
TOTAL ANNUAL MAINTENANCE	$56,530	$66,798

The total annual costs for construction and maintenance on the Interstate Routes are shown below:

	NORTH ROUTE	SOUTH ROUTE
ANNUAL CONSTRUCTION COSTS	$321,630	$337,150
ANNUAL MAINTENANCE COSTS	56,530	66,798
COMBINED ANNUAL INTERSTATE COSTS	$378,160	$403,948
SAVINGS IN FAVOR OF NORTH ROUTE	$ 25,788	

It has been mentioned previously that the costs of construction and maintenance of the Interstate highway are major considerations in the analysis, however, attention must also be given to the construction and maintenance of FAS Route 335 on the south side of the river. If the Interstate highway were to be built on the north side of the river, it would be necessary to construct to oiled standards the entire length of FAS Route 335 on the south side of the river to serve the traffic there. If the Interstate highway were to be constructed on the south side of the river, it would take the place of the first 12 miles of FAS Route 335, however, it would still be necessary to construct the remaining 4 miles of this route to serve the traffic not served by the Interstate highway. The following shows the details of arriving at the costs for construction and maintenance of the FAS facilities:

SECONDARY SYSTEM CONSTRUCTION AND MAINTENANCE COSTS

	NORTH ROUTE	SOUTH ROUTE
Construction of first 12 miles - total cost	$780,000	$ - - -
Construction of first 12 miles - annual cost	26,000	- - -
Construction of remaining 4 miles-total cost	66,000	66,000
Construction of remaining 4 miles-annual cost	2,200	2,200
Maintenance of first 12 miles-annual cost	6,000	- - -
Maintenance of remaining 4 miles-annual cost	2,000	2,000
TOTAL ANNUAL COST OF SECONDARY SYSTEM	$ 36,200	$ 4,200

As explained previously, the present highway on the north side of the river is of recent age and could be expected to provide adequate service without reconstruction for many years to come. Therefore, no construction or reconstruction charges are being assessed against the South Route proposal; however, the maintenance charges on this highway are a proper charge against the South Route proposal. These charges are computed at a rate of $1,000 per mile for 30.5 miles, making a total of $30,500 per year chargeable against the South Route.

A summary of construction and maintenance costs shows the following:

ANNUAL COSTS	NORTH ROUTE	SOUTH ROUTE
INTERSTATE CONSTRUCTION COSTS	$321,630	$337,150
INTERSTATE MAINTENANCE COSTS	56,530	66,798
TOTAL INTERSTATE COSTS	$378,160	$403,948
SECONDARY CONSTRUCTION COSTS	$ 28,200	$ 2,200
SECONDARY MAINTENANCE COSTS	8,000	2,000
TOTAL SECONDARY COSTS	$ 36,200	$ 4,200
PRIMARY MAINTENANCE COSTS	- - -	$ 30,500
TOTAL CONSTRUCTION COSTS	$349,830	$339,350
TOTAL MAINTENANCE COSTS	64,530	99,298
GRAND TOTAL OF ANNUAL COSTS	$414,360	$438,648
ANNUAL SAVINGS IN FAVOR OF NORTH ROUTE	$ 24,288	

It may be noted that the North Route proposal would be the most favorable when all construction and maintenance costs are taken into consideration. Savings under this proposal would amount to $24,288 per year.

TRAFFIC SERVICE

Service to traffic is of utmost importance in analyses of this type. It was explained in the foreword that the highway user pays for the cost of constructing and maintaining highway facilities, and he also pays for the cost of operating his vehicle on the facilities. Almost without exception the annual cost of vehicle operation is many times greater than the annual cost of construction and maintenance. For that reason, traffic service has an important bearing on the final selection of the most beneficial routing proposal.

Traffic counts, which have been made for many years on highways and county roads in the vicinity of Glendive and Fallon, provide a foundation for appraising the highway transportation situation in the region. The basic traffic counts have been supplemented by an origin-destination survey which was made at peripheral stations near Glendive in the summer of 1956. This survey revealed information concerning the movement of traffic through the city, and it also disclosed the zone within the city in which the trips originated or ended. Another origin-destination survey was made on US #10 south of Glendive in July 1959 in order to obtain special information concerning the proportion of traffic that was of local origin in the rural area between Fallon and Glendive.

From these various sources, information is available which permits the assignment of traffic to the various roads and highways which are involved in the analysis.

Present Conditions

The enclosed area map identifies a series of control points pertaining to the North Route and to the South Route. The following shows the amount and type of traffic using the present highway between these control points:

	PRESENT PRIMARY HIGHWAY		
	AVERAGE DAILY TRAFFIC		
CONTROL POINTS	AUTOMOBILES	TRUCKS	ALL VEHICLES
N1 to N2	841	167	1,008
N2 to N3	776	149	925
N3 to N4	898	173	1,071
N4 to Mont. 20S	1,020	197	1,217
Mont. 20S to Mont. 16	988	182	1,170
Mont. 16 to Glendive	931	160	1,091
Through Glendive	779	171	950
Glendive to C5	779	171	950
AVERAGE FOR ENTIRE ROUTE	840	163	1,003

The traffic between Control Point N4 and C5 is actually much greater than the figures shown above, however, this analysis is concerned with only the traffic that would be affected by the routing proposals, and for this reason, the extraneous traffic has been omitted from the calculations in the interest of simplifying the computations.

The following shows the present traffic on FAS Route 335 which extends southward from Glendive towards the oil fields:

	PRESENT FAS ROUTE 335		
	AVERAGE DAILY TRAFFIC		
SECTION	AUTOMOBILES	TRUCKS	ALL VEHICLES
In Glendive	1,406	74	1,480
To Interstate turnoff	265	46	311
Interstate turnoff to end	121	21	142
AVERAGE FOR ENTIRE ROUTE	287	36	323

The Interstate turnoff, which is identified above, is a point located about 12 miles from Glendive where a proposed Interstate highway interchange with FAS Route 335 will permit entry to or exit from the Interstate highway. This represents a point where there will be a major change in traffic on the South Route.

Beyond the end of FAS Route 335, a county road continues through the community of Marsh and connects with FAS Route 340 leading to Fallon. Traffic on this road is included in the analysis for the reason that the South Route will serve a few vehicles which are now using the county road for their travel. Present traffic on this county road amounts to 45 automobiles per day and 10 trucks, making a total of 55 vehicles per day for the length of the road.

Since the alternate Interstate System routes will differ in service and connections to the city, it is necessary to determine the amount and type of traffic that would be affected by these routings. The traffic data show that there would be 931 automobiles and 160 trucks, or a total of 1,091 vehicles that would be affected. It may be noted that these are the same vehicles which were reported as approaching the city in the table pertaining to present traffic on rural US #10.

North Route

The North Route would follow about the same line as the present highway between Control Points N1 to N4, and it would preserve the essential intersections with present county roads. Therefore, the traffic between Control Points N1 and N4 remains the same as was reported for the present highway. Between these points the North Route will continue to serve a substantial volume of through traffic equal to 651 vehicles per day. In addition, it will serve an average of 361 vehicles per day of traffic originating in the well developed irrigated farming area between the highway and the Yellowstone River and also the traffic coming from the area to the north of the highway.

At Control Point N4, the Interstate highway will leave the present highway, and it will follow a new line to the south of the city. The trip origin and destination interviews indicate that about 56% of the traffic at this point would continue to follow the present highway to the connections with Montana 16 and 20S and into the city. The remaining 44% of the traffic would use the new Interstate line in traveling to the south part of the city and to points east of Glendive.

At Control Point C1, an interchange will be located to permit entry to and exit from the city and to connect with FAS Route 335. This will be a major point of access to the city with a consequent change in the traffic volume. Another point of access to the city will be located at Control Point C3 where an interchange will be located in the vicinity of Graveyard Coulee.

From C3 to the end of the route at C5, there will be a substantial increase in the traffic because of the pickup of Glendive-Wibaux traffic.

The following table shows the amount and type of traffic that has been assigned to the North Route of the Interstate System:

	NORTH INTERSTATE HIGHWAY		
	AVERAGE DAILY TRAFFIC		
SECTION	AUTOMOBILES	TRUCKS	ALL VEHICLES
N1 to N2	841	167	1,008
N2 to N3	776	149	925
N3 to N4	898	173	1,071
N4 to N5	505	90	595
N5 to C1	223	71	294
C1 to C2	363	79	442
C2 to C3	363	79	442
C3 to C4	779	171	950
C4 to C5	779	171	950
AVERAGE FOR ENTIRE ROUTE	767	150	917

It was previously stated that about 56% of the traffic at Control Point N4 would continue to use the present highway to connections with Montana 16 and 20S and to points in the northern section of the city and vicinity. The following table shows the traffic that would continue to use this section of the present highway:

	NORTH PRIMARY HIGHWAY		
	AVERAGE DAILY TRAFFIC		
SECTION	AUTOMOBILES	TRUCKS	ALL VEHICLES
N4 to Mont. 20S	515	107	622
Mont. 20S to Mont. 16	483	92	575
Mont. 16 to Glendive	426	70	496
AVERAGE FOR SECTIONS	486	95	581

Since the North Route would not replace any part of FAS Route 335, there would be no change in the present traffic on this route as reported in the table under "Present Conditions", with the exception that there would be a minor change in the traffic pattern in entry to Glendive.

The North Route would provide better access to the city than exists under present conditions because of the more direct service to the southern sections of the city. The number of vehicles served, however, would remain the same as described under the section pertaining to "Present Conditions."

There would be no change in the traffic on county roads as reported under the section pertaining to "Present Conditions".

South Route

If the South Route of the Interstate System were to be built, there would be a major change in the traffic pattern in the general area between Fallon and Glendive. It was previously reported that 651 vehicles per day of through traffic could be expected to divert from the present highway to the new Interstate highway on the south side of the Yellowstone River. This would leave 361 vehicles per day of local traffic that would continue to use the present highway on the north side of the river.

An Interstate System highway on the south side of the river would be of major benefit to the traffic now using the low standard roads on FAS Route 335. This benefit would apply especially to the traffic to the oil fields. The Pine Unit field, which is the major destination, has achieved the position of largest producer in the State. This field was discovered in 1952 and has numerous producing wells, with new ones being added continually. Oil from this field is brought to Glendive by pipeline, but there are numerous vehicles, both passenger and truck, traveling to the field in connection with production, drilling and service activities. There is also some traffic movement to other oil fields in this general area of the State.

The population is rather sparse in the area served by the South Route. Also the Interstate highway is so located that it would not provide direct service to most of the farms and ranches. The greatest benefit would be realized in connections with intersecting roads bearing traffic to Glendive, Marsh and Fallon.

The following tables show the estimated distribution of traffic by different roads and highways if the Interstate highway were to be built on the south side of the river:

SECTION	SOUTH INTERSTATE HIGHWAY AVERAGE DAILY TRAFFIC AUTOMOBILES	TRUCKS	ALL VEHICLES
S1 to S2	599	87	686
S2 to S3	580	84	664
S3 to S4	580	84	664
S4 to S5	587	85	672
S5 to S6	601	89	690
S6 to S7	619	93	712
S7 to C1	799	107	906
C1 to Interchange	799	107	906
Interchange to C3	237	61	298
C3 to C4	779	171	950
C4 to C5	779	171	950
AVERAGE FOR ENTIRE ROUTE	640	96	736

SECTION	NORTH SIDE PRIMARY HIGHWAY AVERAGE DAILY TRAFFIC AUTOMOBILES	TRUCKS	ALL VEHICLES
N1 to N2	272	85	357
N2 to N3	207	67	274
N3 to N4	329	91	420
N4 to Mont. 20S	451	115	566
Mont. 20S to Mont. 16	419	100	519
Mont. 16 to Glendive	362	78	440
AVERAGE FOR ENTIRE ROUTE	280	81	361

The south side Interstate highway would provide service for only a portion of the traffic now using FAS Route 335 and county roads on that side of the river. Traffic on the southern 4 miles of FAS Route 335 would not be served by the Interstate highway. Also, the present portion of FAS Route 335 immediately west of Glendive would have no connection to the Interstate highway, and local residents would have to continue using the existing road. A small portion of the traffic on the county road to Marsh and Fallon would be served by the Interstate highway, but there will remain a few vehicles per day which will continue to use the county road.

A summary of this traffic off the Interstate highway is presented below:

SECTION	SOUTH SIDE TRAFFIC OFF INTERSTATE HIGHWAY AVERAGE DAILY TRAFFIC AUTOMOBILES	TRUCKS	ALL VEHICLES
South 4 miles FAS 335	121	21	142
Glendive-West FAS 335	196	24	220
County roads to Marsh and Fallon	16	4	20

The number of vehicles using city streets in Glendive would remain the same as described under "Present Conditions." These would amount to 931 automobiles per day, and 160 trucks, or a total of 1,091 vehicles per day. As a result of the additional access points, the service to this traffic would be improved over existing conditions, however, the service would be less than that provided by the North Route.

HIGHWAY TRANSPORTATION COSTS

The foregoing material under TRAFFIC SERVICE describes the present usage of highways, roads and streets and presents an estimate of the redistribution of traffic if the Interstate highway were to be located on either the North Route or the South Route. The service to traffic may be evaluated in monetary terms by computing the annual vehicle-miles of traffic on each type of road and street and by multiplying these vehicle-miles of traffic by established cost factors for each type of vehicle and each type of facility. These cost factors are based on recommended unit values contained in a publication of the American Association of State Highway Officials. The original values were based on operating costs prevailing during 1952, so they have been increased to correspond to the present price level:

TYPE OF FACILITY	OPERATING COSTS PER VEHICLE-MILE AUTOMOBILES	TRUCKS
Interstate highway-rural	$.0925	$.2920
Primary highway-rural	$.1105	$.3473
Secondary highway-rural	$.1140	$.3583
County roads-rural	$.1289	$.3867
City streets - urban	$.1409	$.4428

The following shows the results of the computation of vehicle-miles of traffic on each system and the application of the foregoing basic operating costs:

UNDER PRESENT CONDITIONS

TYPE OF HIGHWAY FACILITY	ANNUAL VM OF TRAFFIC	AVERAGE UNIT COST	TOTAL ANNUAL COST
Primary highway-rural	12,313,640	$.1526	$1,879,590
Secondary highway-rural	1,883,765	.1629	306,895
County roads-rural	584,365	.1758	102,707
City streets-urban	705,180	.1901	134,071
TOTAL	15,486,950	$.1565	$2,423,263

WITH NORTH INTERSTATE ROUTE

TYPE OF HIGHWAY FACILITY	ANNUAL VM OF TRAFFIC	AVERAGE UNIT COST	TOTAL ANNUAL COST
Interstate highway-rural	11,759,935	$.1259	$1,480,652
Primary highway-rural	635,465	.1491	94,766
Secondary highway-rural	1,813,685	.1522	275,954
County roads-rural	584,365	.1758	102,707
City streets-urban	239,075	.1851	44,264
TOTAL	15,032,525	$.1329	$1,998,343

WITH SOUTH INTERSTATE ROUTE

TYPE OF HIGHWAY FACILITY	ANNUAL VM OF TRAFFIC	AVERAGE UNIT COST	TOTAL ANNUAL COST
Interstate highway-rural	10,295,190	$.1210	$1,245,432
Primary highway-rural	4,026,315	.1638	659,603
Secondary highway-rural	207,320	.1501	31,124
County roads-rural	862,860	.1628	140,428
City streets-urban	318,645	.1851	59,002
TOTAL	15,710,330	$.1359	$2,135,589

These computations show that the North Route, with related facilities, would save the highway user $424,920 per year in vehicle operating costs in comparison with present conditions. The South Route and related facilities would save the highway user $287,674 per year in operating costs in comparison with present conditions. These computations also show that the North Route combination would save the highway user $137,246 per year in comparison with the South Route combination.

SUMMARY OF ALL COSTS

As explained in the foreword, the most favorable route would be the one that has the lowest overall cost when the combined construction, maintenance and operating costs are taken into consideration for all facilities involved in the highway transportation situation in the general area. The following shows a comparison of all costs involved:

ANNUAL COSTS INVOLVED IN -	NORTH ROUTE COMBINATION	SOUTH ROUTE COMBINATION
Interstate construction	$ 321,630	$ 337,150
Interstate maintenance	56,530	66,798
Subtotal	378,160	403,948
Secondary construction	28,200	2,200
Secondary maintenance	8,000	2,000
Subtotal	36,200	4,200
Primary maintenance	- - -	30,500
ALL CONSTRUCTION	349,830	339,350
ALL MAINTENANCE	64,530	99,298
Subtotal	414,360	438,648
VEHICLE OPERATION	1,998,343	2,135,589
GRAND TOTAL OF ALL ANNUAL COSTS	$2,412,703	$2,574,237
ANNUAL SAVINGS IN FAVOR OF NORTH ROUTE	$161,534	

This summary shows that the construction of the Interstate highway on the north side of the river would save $24,288 per year in construction and maintenance costs and it would save the highway user $137,246 per year in operating costs in comparison with the proposal that the Interstate highway be constructed on the south side of the river. This makes a total savings of $161,534 per year in favor of the North Route. Assuming a service life of 40 years for the Interstate highway, the total savings over this period would amount to $6,461,360.

The benefit-cost ratio provides another means of evaluating the merit of the two alternate route proposals by comparing the annual costs for construction and maintenance with the annual savings to the highway user as the result of the improved highway facilities. The computations for highway transportation costs

showed that the North Route combination would save the highway user $424,920 per year in being able to travel on improved highway facilities in place of present facilities. In a similar comparison, the South Route combination would save the highway user $287,674 per year. Both of these figures are based on present traffic volumes, and the figures should be doubled to compensate for the 100% increase in traffic that is expected to result as an average during the estimated lives of the highway improvement. These figures would consequently become $849,840 for the North Route combination and $575,348 for the South Route combination.

The following benefit-cost ratio shows the relationship between operating cost savings and construction and maintenance costs:

	NORTH ROUTE COMBINATION		SOUTH ROUTE COMBINATION	
Annual operating cost savings	$849,840	= 2.0510	$575,348	= 1.3116
Annual Const. & mtce. costs	$414,360		$438,648	

In simple terms, $1.00 spent for construction and maintenance on the North Route Combination would save the highway user $2.05. The expenditure of $1.00 for construction and maintenance on the South Route combination would save the highway user $1.31. This is a differential of about 56% in favor of the North Route combination.

CONCLUSIONS

On the basis of the results of this analysis, it must be concluded that the location of the Interstate System highway on the north side of the Yellowstone River represents the most favorable solution to the general highway transportation problem. The annual construction and maintenance costs for the Interstate highway are lower for the north side location, and they are also lower when the north side Interstate highway is considered in combination with related facilities. The location of the Interstate highway on the north side of the river would also be of greatest benefit to the highway user as revealed in annual savings in operating costs of $137,246 per year.

These savings in operating costs result for the following reasons:

1. The North Route, being 2.4 miles shorter than the South Route, would save 651 vehicles per day of through traffic this additional travel. The annual savings would amount to $68,205.

2. There are 361 vehicles per day of locally-generated traffic using the highway between Fallon and Glendive. These vehicles would be able to realize the benefits of a north side Interstate highway whereas they would be restricted to the present lower-standard highway if the Interstate highway were to be located on the south side of the river. The value of being able to use the Interstate highway amounts to $116,948 per year for these vehicles.

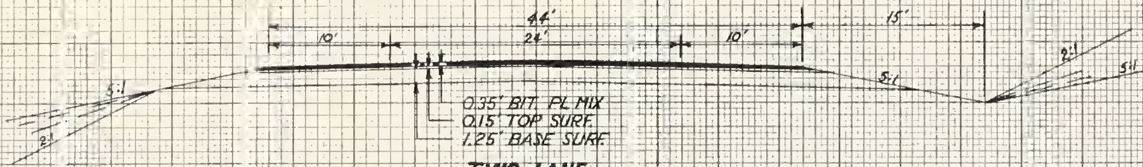
3. These benefits for the North Route amount to an annual total of $185,153. They are offset to some degree by benefits in favor of the South Route which result from the ability of traffic on the south side of the river to use the high-standard Interstate highway in place of the low-standard roads there. These savings in favor of the South Route amount to $28,137 per year for traffic now using FAS Route 335 and $19,770 per year for traffic now using other county roads. The net difference between the savings in favor of the North Route and the South Route amounts to the $137,246 figure previously reported.

The savings in vehicle operating cost of $137,246 per year plus the savings in construction and maintenance costs of $24,288 per year results in a total savings of $161,534 per year in favor of locating the Interstate System highway on the north side of the river. The benefit/cost analysis also shows a differential of about 56% in favor of the North Route for the Interstate highway.

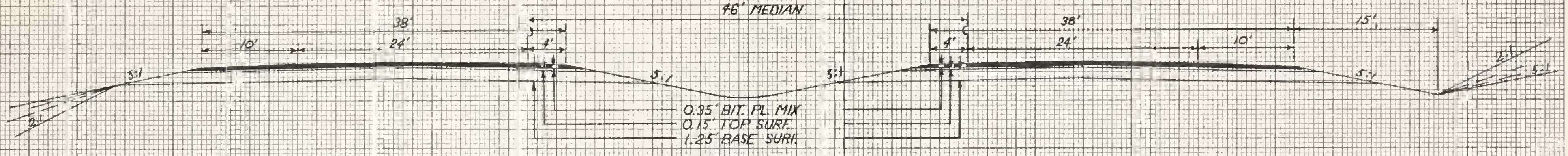
It is considered that the results of this analysis conclusively support the construction of the Interstate System highway on the north side of the Yellowstone River.

FALLON – GLENDIVE
LOCATION STUDY

TYPICAL SECTIONS



TWO LANE



FOUR LANE

LENGTH NORTH ROUTE

STATION		LIN. FEET		REMARKS
FROM	TO	2-LANE	4-LANE	
320+00	533+40	21340.0		N1 – N2
533+40 BK	= 0+00 AH	~		EQUATION
0+00	667+00	66700.0		N2 – N3
667+00 BK	= 668+00 AH	~		EQUATION
668+00	1244+89.3	57689.3		N3 – N4
1244+89.3 BK	= 0+00 AH	~		EQUATION
0+00	135+00	13500.0		N4 – N5
135+00	169+80.7		3480.7	N5 – C1
169+80.7	180+00		1019.3	C1 – C2
180+00	271+53.8		9153.8	C2 – C3
271+53.8 BK	= 271+38.5 AH	~	~	EQUATION
271+38.5	340+00		6861.5	C3 – C4
340+00	395+69.7	5569.7		C4 – C5
SUB-TOTAL		164799.0	20515.3	
TOTAL LENGTH = 185314.3 FT. = 35.097 MI.				

NORTH ROUTE STRUCTURES

STATION	STRUCTURE WIDTH				REMARKS	SEC.
	24'	28'	38'	44'		
450±		240'			O'FALLON CREEK	N1
469±		200'			N.P. O-PASS.	N1
480±				140'	FALLON INTERCHANGE	N1
42±		1160'			YELLOWSTONE RIVER	N2
51±				140'	INTERCHANGE	N2
158±				100'	HATCHET CREEK	N2
317±		180'			BAD ROUTE CREEK	N2
565±		180'			CRACKER BOX CREEK	N2
652±				140'	INTERCHANGE	N2
820±				60'	U.S.R.S. CANAL	N3
826±		210'			CLEAR CREEK	N3
842±				60'	U.S.R.S. CANAL	N3
945±				140'	INTERCHANGE	N3
982±				80'	WHOOPUP CREEK	N3
1066±		210'			SEPARATION	N3
1083±				60'	U.S.R.S. CANAL	N3
1088±				100'	SAND CREEK	N3
1109±				50'	U.S.R.S. CANAL	N3
1239±				50'	U.S.R.S. CANAL	N3
8±	200'				INTERCHANGE	N4
26±				140'	CO. RD. SEPARATION	N4
87±		1800'			YELLOWSTONE RIVER	N4
126±		240'			N.P. O-PASS.	N4
155±		310'			INTERCHANGE	N5
212±		(2) 340'			SEPARATION	C2
276±			(2) 280'		INTERCHANGE	C3
365±		210'			GLENDIVE CREEK	C4
374±		240'			N.P. O-PASS & INTERCHANGE	C4
TOTAL	200'	5520'	280'	1260'		

LENGTH SOUTH ROUTE

STATION		LIN. FEET		REMARKS
FROM	TO	2-LANE	4-LANE	
320+00	446+00	12600.0		S1 – S2
446+00 BK	= 0+00 AH	~	~	EQUATION
0+00	110+00	11000.0		S1 – S2
110+00	200+00		9000.0	S2 – S3
200+00	364+95	16495.0		S3 – S4
364+95 BK	= 265+63 AH	~	~	EQUATION
265+63	340+00	7437.0		S3 – S4
340+00	410+00		7000.0	S4 – S5
410+00	860+39	45039.0		S5 – S6
860+39 BK	= 862+55 AH	~	~	EQUATION
862+55	920+00	5745.0		S5 – S6
920+00	1160+00		24000.0	S6 – S7
1160+00	1431+14.1	27114.1		S7 – C1
1431+14.1 BK	= 1407+64.6 AH	~	~	EQUATION
1407+64.6	1505+13.7	9749.1		S7 – C1
1505+13.7 BK	= 169+80.7 AH	~	~	EQUATION
169+80.7	180+00	1019.3		C1 – C2
180+00	271+53.8		9153.8	C2 – C3
271+53.8 BK	= 271+38.5 AH	~	~	EQUATION
271+38.5	340+00		6861.5	C3 – C4
340+00	395+69.7	5569.7		C4 – C5
SUB-TOTAL		141768.2	56015.3	
TOTAL LENGTH = 197,783.5 FT. = 37.459 MI.				

SOUTH ROUTE STRUCTURES

STATION	STRUCTURE WIDTH				REMARKS	SEC.
	28'	24'	38'	44'		
328±	210'				P.T.W. INTERCHANGE	S1
444±		240'			O'FALLON CREEK	S1
60±				120'	CO. RD. SEPARATION	S1
88±		220'			DRAINAGE	S1
135±		(2) 340'			FAS 340 INTERCHANGE	S2
533±		160'			MARSH INTERCHANGE	S5
744±		240'			CABIN CREEK	S5
1009±		(2) 520'			CEDAR CREEK	S6
1042±			(2) 240'		SEPARATION	S6
1092±		280'			FAS 335 INTERCHANGE	S6
1295±		200'			DRAINAGE	S7
212±		(2) 340'			INTERCHANGE	C2
276±			(2) 280'		INTERCHANGE	C3
365±		210'			GLENDIVE CREEK	C4
374±		240'			N.P.O-PASS & INTERCHANGE	C4
TOTAL	210'	2990'	520'	120'		

PLATE 3 CROSS SECTION [illegible] STANDARD

PRELIMINARY COST ESTIMATE

SHEET ____ OF ____

PROJECT W. of Fallon to E. of Glendive

LOCATION NORTH ROUTE

Section	N1 - N2	N2 - N3	N3 - N4	N4 - N5	N5 - C1	C1 - C2	C2 - C3	C3 - C4	C4 - C5			TOTAL
Length. miles	4.042	12.633	10.926	2.557	.659	.193	1.733	1.299	1.055			35.097
1977 DHV	330	300	350	275	180	200	200	310	310			---
Number of lanes	2	2	2	2	4	4	4	4	2			---
WORK CLASSIFICATION	ESTIMATED COSTS (1,000 Dollars)											
1. Preliminary engineering	33	116	72	120	16	7	38	30	19			451
2. Right-of-Way	38	13	10	14	1	1	507	2	2			588
3. Clear & grub; demolition	—	—	—	—	--	--	—	—	—			---
4. Utility adjustments	—	—	—	—	--	—	80	—	--			80
5. Grade & drain; minor structures	157	386	327	318	76	127	340	264	135			2,130
6. Base; surfacing; shoulders	233	733	637	151	74	21	189	140	64			2,242
7. R. R. grade separations	78	—	—	94	--	—	--	—	94			266
8. Highway grade separations without ramps	—	—	73	81	--	—	121	—	—			275
9. Interchanges, complete	121	223	128	86	164	—	—	195	23			940
10. Other bridges; tunnels	77	1,033	288	1,620	--	--	—	—	67			3,085
11. Walls	—	--	—	—	—	—	—	—	--			---
12. Guardrail; fencing; lighting; traffic control devices	26	51	42	45	11	2	55	23	15			270
13. Roadside improvement	—	—	—	--	—	--	15	--	--			15
14. All other items	—	—	—	100	--	--	--	--	—			100
15. Subtotal, lines 3 to 14	692	2,426	1,495	2,495	325	150	800	622	398			9.403
16. Construction Engineering & Contingencies, 10% of line 15	69	243	150	250	33	15	80	62	40			942
17. Total Estimated Cost	832	2,798	1,727	2,879	375	173	1,425	716	459			11,384

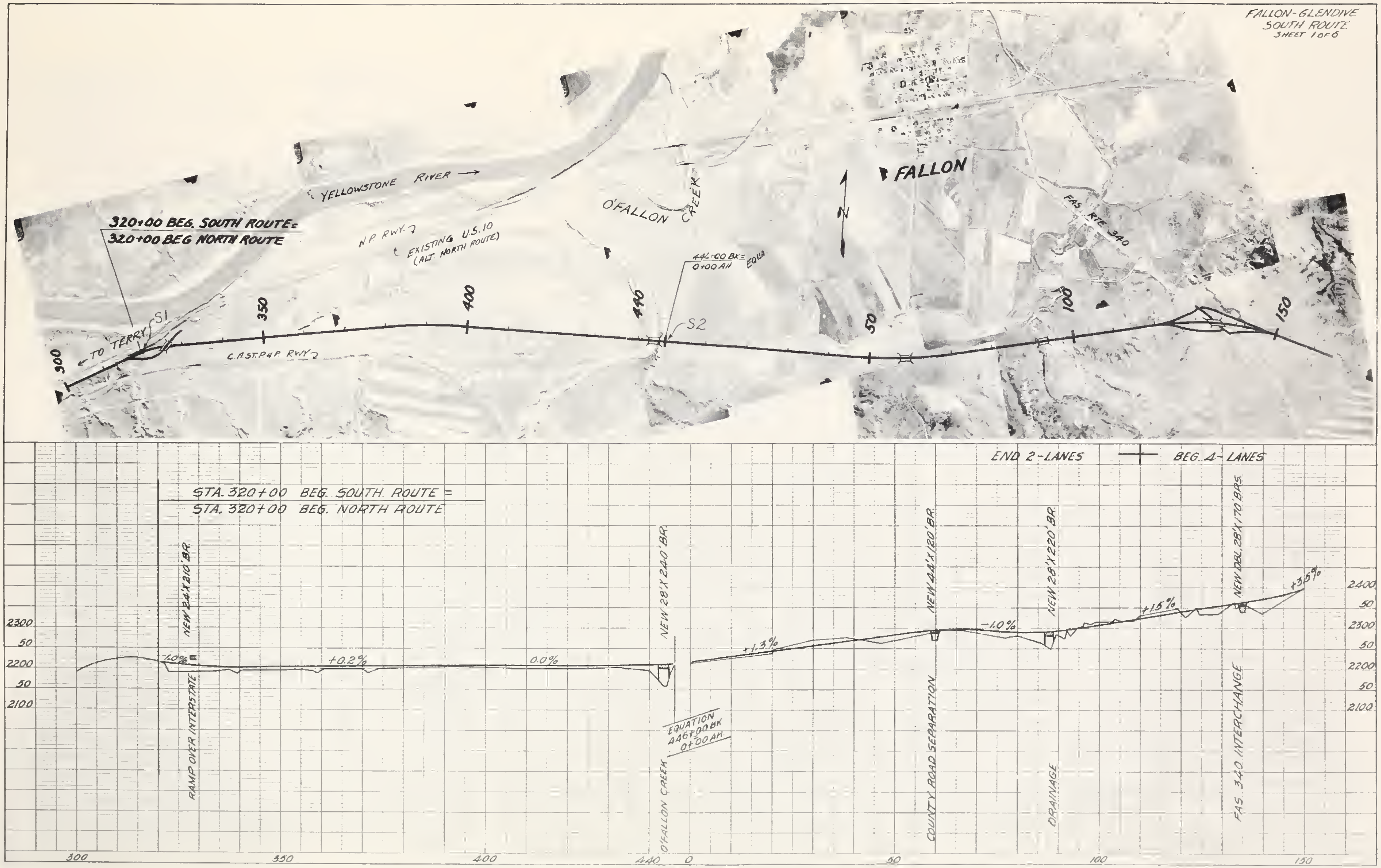
PRELIMINARY COST ESTIMATE

SHEET ____ OF ____

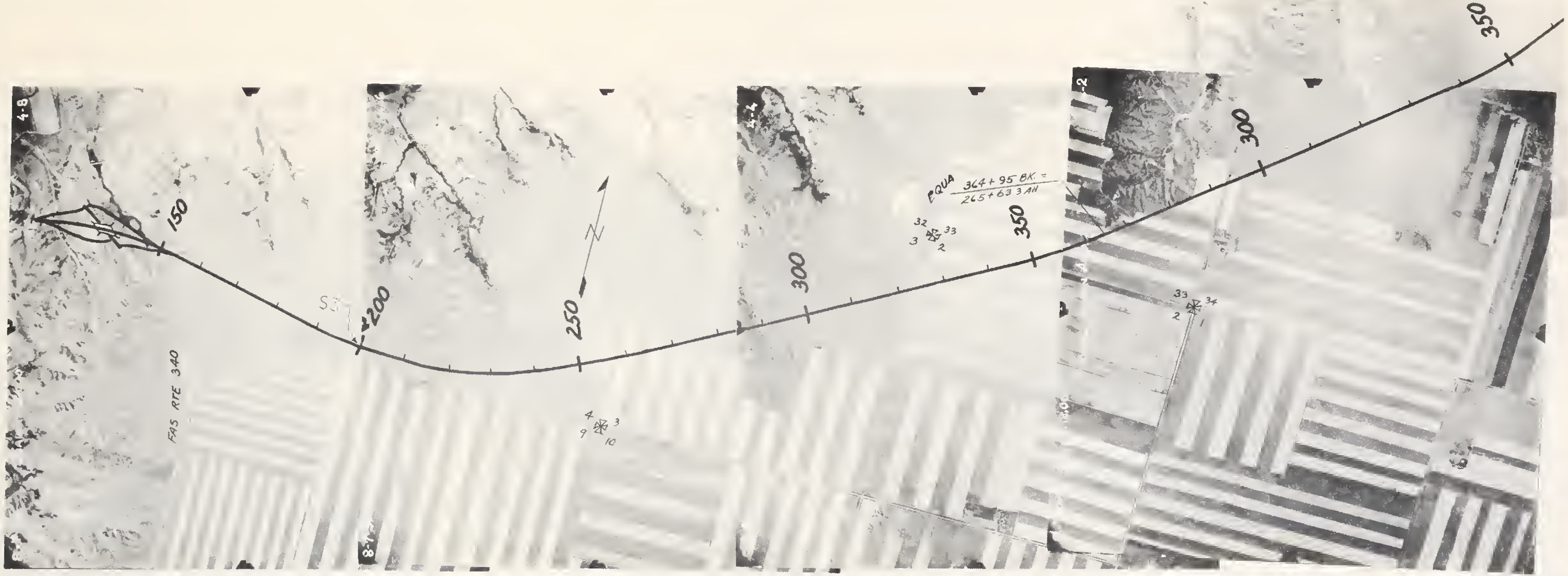
PROJECT W. of Fallon to E. of Glendive

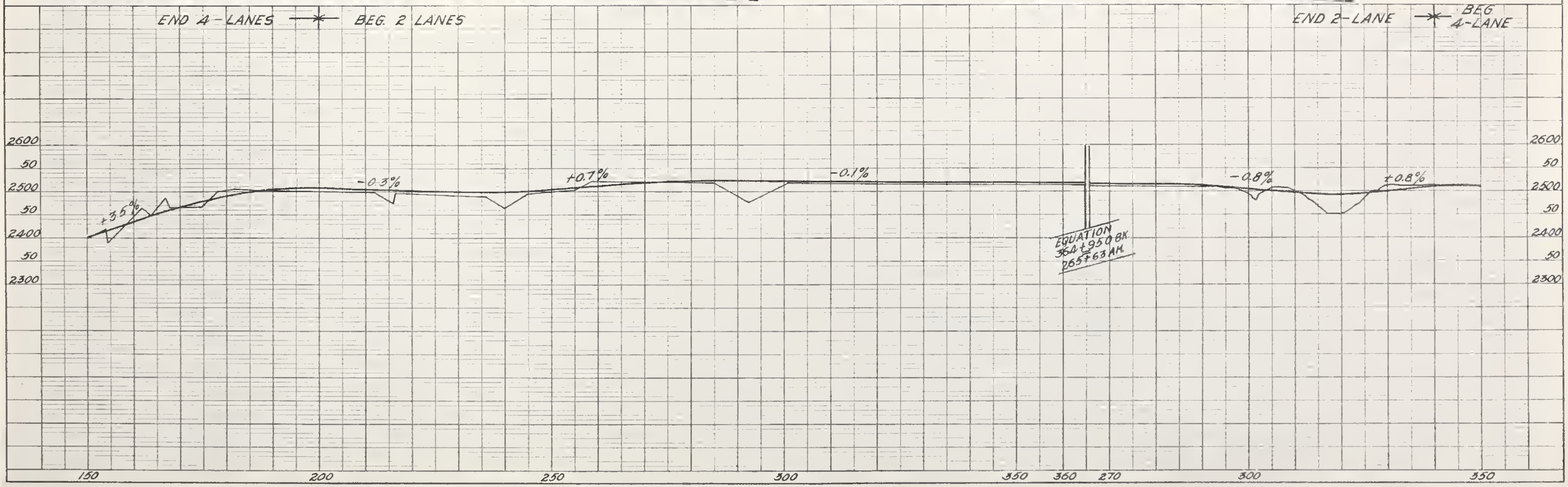
LOCATION SOUTH ROUTE

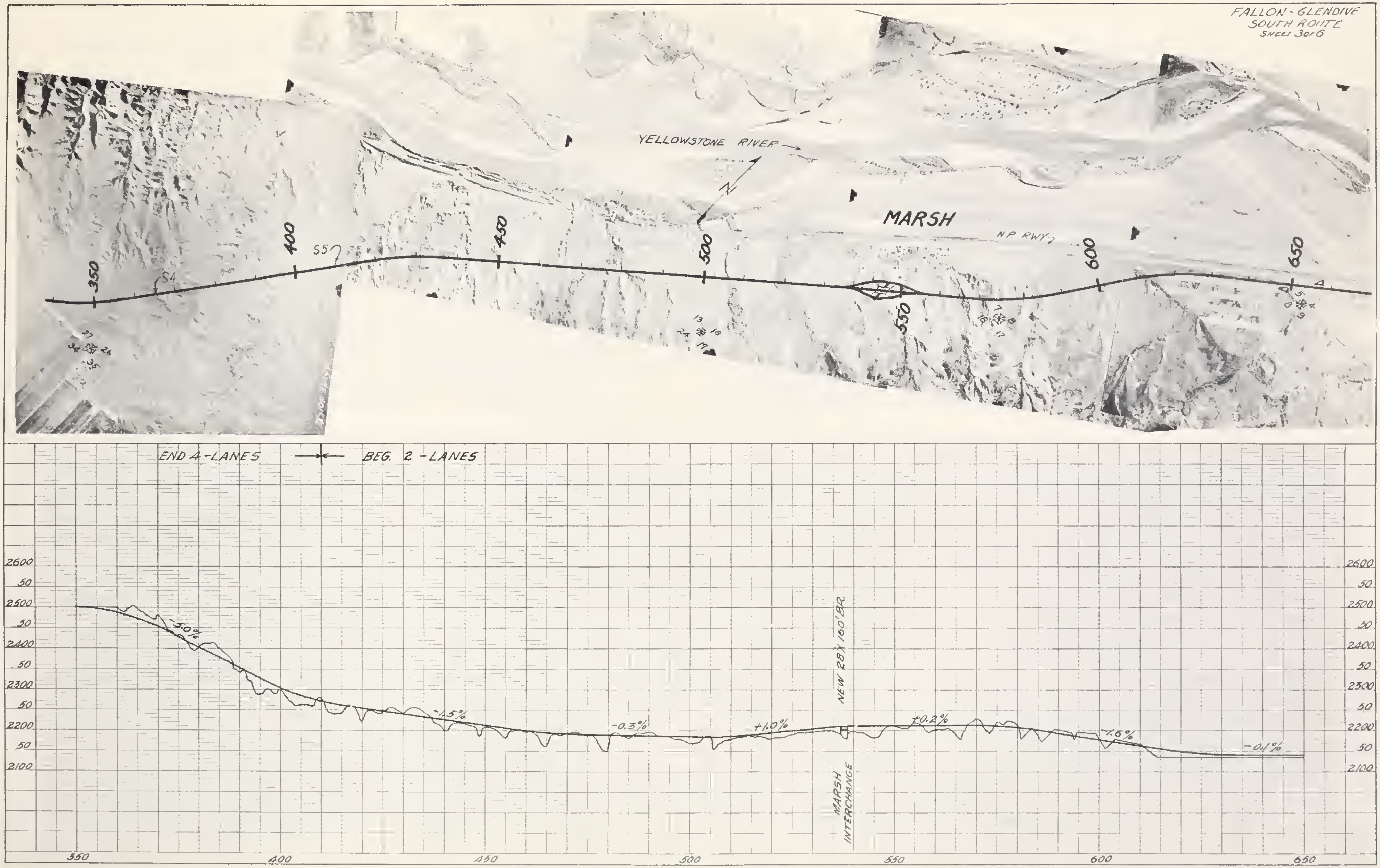
Section	S-1 – S2	S2 – S3	S3 – S4	S4 – S5	S5 – S6	S6 – S7	S7 – C1	C1 – C2	C2 – C3	C3 – C4	C4 – C5	TOTAL
Length, miles	4.469	1.705	4.533	1.326	9.618	4.546	6.982	.193	1.733	1.299	1.055	37.459
1977 DHV	220	210	210	220	220	230	300	300	110	310	310	---
Number of lanes	2	4	2	4	2	4	2	2	4	4	2	---
WORK CLASSIFICATION	ESTIMATED COSTS (1,000 Dollars)											
1. Preliminary engineering	39	24	28	14	59	119	53	6	40	30	19	431
2. Right-of-Way	44	11	16	2	39	11	16	1	507	2	2	651
3. Clear & grub; demolition	—	—	—	—	—	—	—	—	—	—	—	—
4. Utility adjustments	—	—	—	—	—	—	20	—	80	—	—	100
5. Grade & drain; minor structures	243	118	289	134	430	1460	586	117	340	264	135	4116
6. Base; surfacing; shoulders	262	179	262	137	559	493	407	12	189	140	64	2704
7. R. R. grade separations	—	—	—	—	—	—	—	—	—	—	94	94
8. Highway grade separations without ramps	68	—	—	—	—	106	—	—	—	—	--	174
9. Interchanges, complete	82	177	—	—	116	173	—	—	144	195	23	910
10. Other bridges; tunnels	147	—	—	—	77	166	64	—	—	—	67	521
11. Walls	—	--	—	—	—	—	—	—	—	—	--	--
12. Guardrail; fencing; lighting; traffic control devices	13	23	27	16	40	76	30	2	55	23	15	320
13. Roadside improvement	—	—	—	—	—	—	—	—	15	—	—	15
14. All other items	—	—	—	—	—	—	—	—	--	—	--	—
15. Subtotal, lines 3 to 14	815	497	578	287	1,222	2,474	1,107	131	823	622	298	8954
16. Construction Engineering & Contingencies, 10% of line 15	82	50	58	29	122	247	111	13	82	62	40	896
17. Total Estimated Cost	980	582	680	332	1,442	2,851	1,287	151	1,452	716	459	10,932


FALLON-GLENDIVE
SOUTH ROUTE
SHEET 1 of 6
320+00 BEG. SOUTH ROUTE =
320+00 BEG NORTH ROUTE
YELLOWSTONE RIVER →
N.P. RWY.
EXISTING U.S. 10
(ALT. NORTH ROUTE)
O'FALLON CREEK
FALLON
N
FAS RTE 340
446+00 BK = 0+00 AH EQUA.
S1
S2
← TO TERRY
C.M.ST.P.&P. RWY.
300
350
400
440
50
100
150
END 2-LANES
BEG. 4-LANES
STA. 320+00 BEG. SOUTH ROUTE =
STA. 320+00 BEG. NORTH ROUTE
NEW 24'X210' BR.
NEW 28'X240' BR.
NEW 44'X120' BR.
NEW 28'X220' BR
NEW DBL. 28'X170' BRS.
-1.0%
+0.2%
0.0%
+1.3%
-1.0%
+1.5%
+3.5%
RAMP OVER INTERSTATE
O'FALLON CREEK
EQUATION 446+00 BK 0+00 AH.
COUNTY ROAD SEPARATION
DRAINAGE
FAS 340 INTERCHANGE
2400
50
2300
50
2200
50
2100
300
350
400
440
0
50
100
150

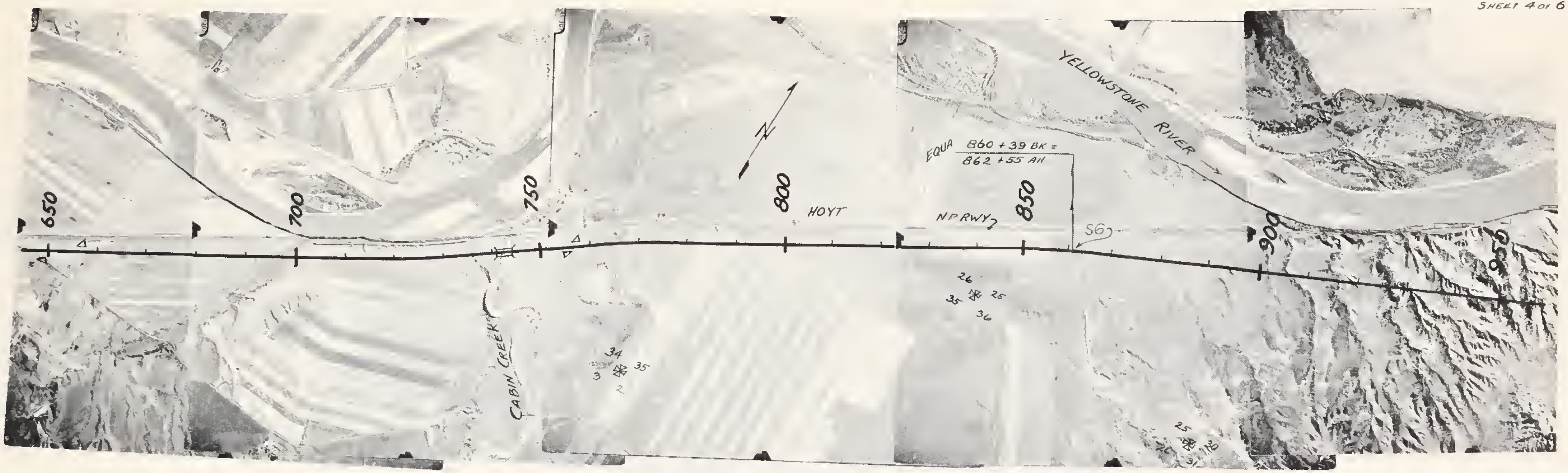
FALLON-GLENDIVE
SOUTH ROUTE
SHEET 2 of 6

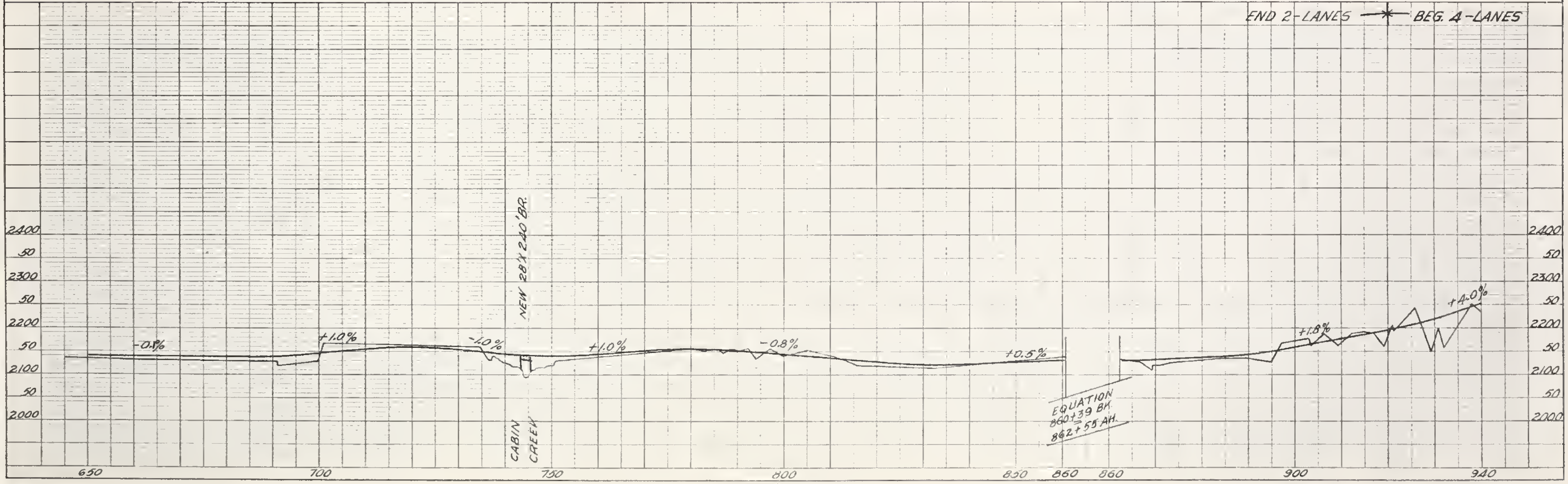


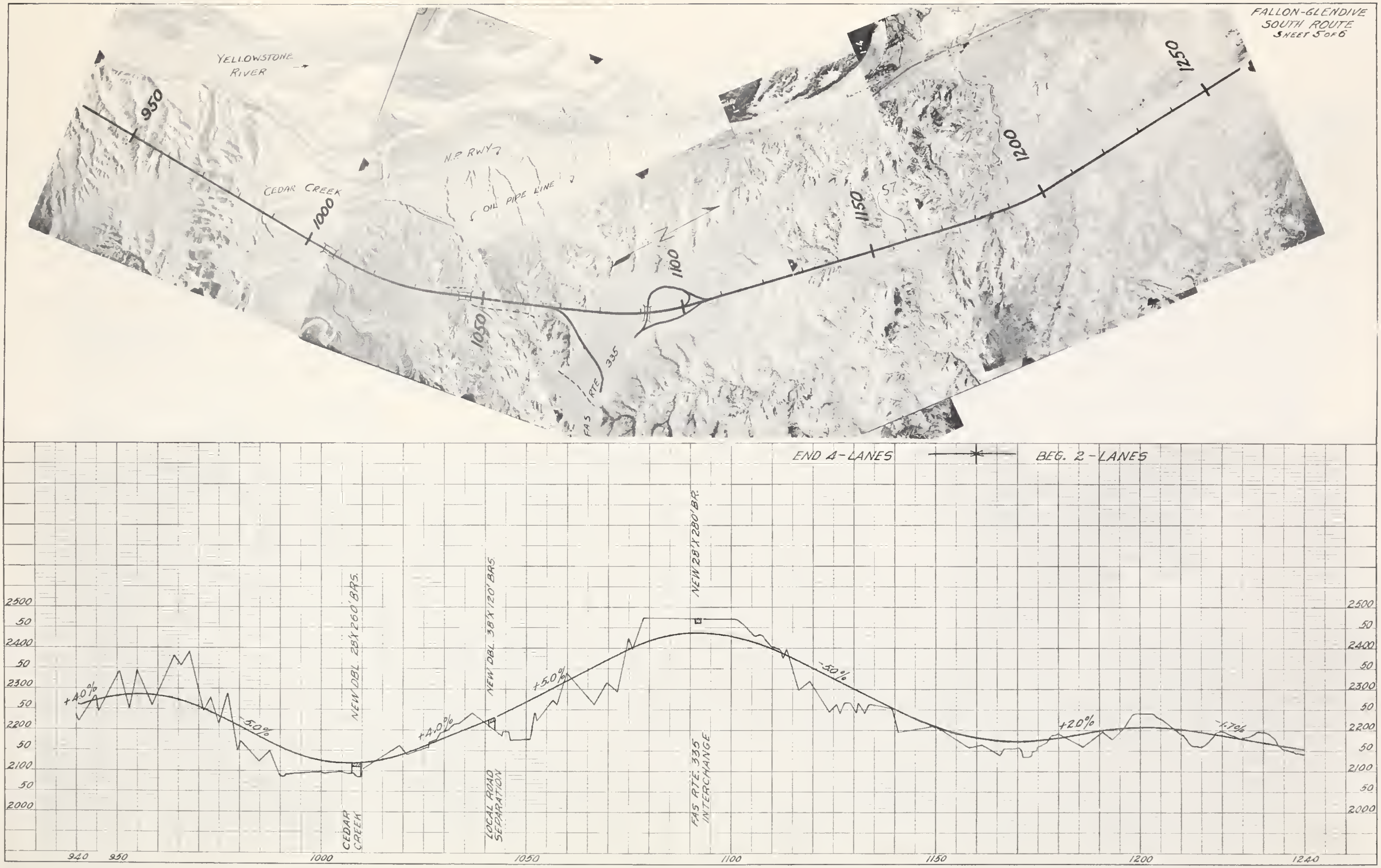



FALLON - GLENDIVE
SOUTH ROUTE
SHEET 3 OF 6
YELLOWSTONE RIVER
N
MARSH
N.P. RWY.
350
400
450
500
550
600
650
S4
S5
27
26
34
35
13
18
24
19
7
8
16
17
5
4
8
9
END 4-LANES
BEG. 2-LANES
-5.0%
-1.5%
-0.3%
+1.0%
NEW 28'x 160' BR.
MARSH INTERCHANGE
+0.2%
-1.6%
-0.1%
2600
50
2500
50
2400
50
2300
50
2200
50
2100

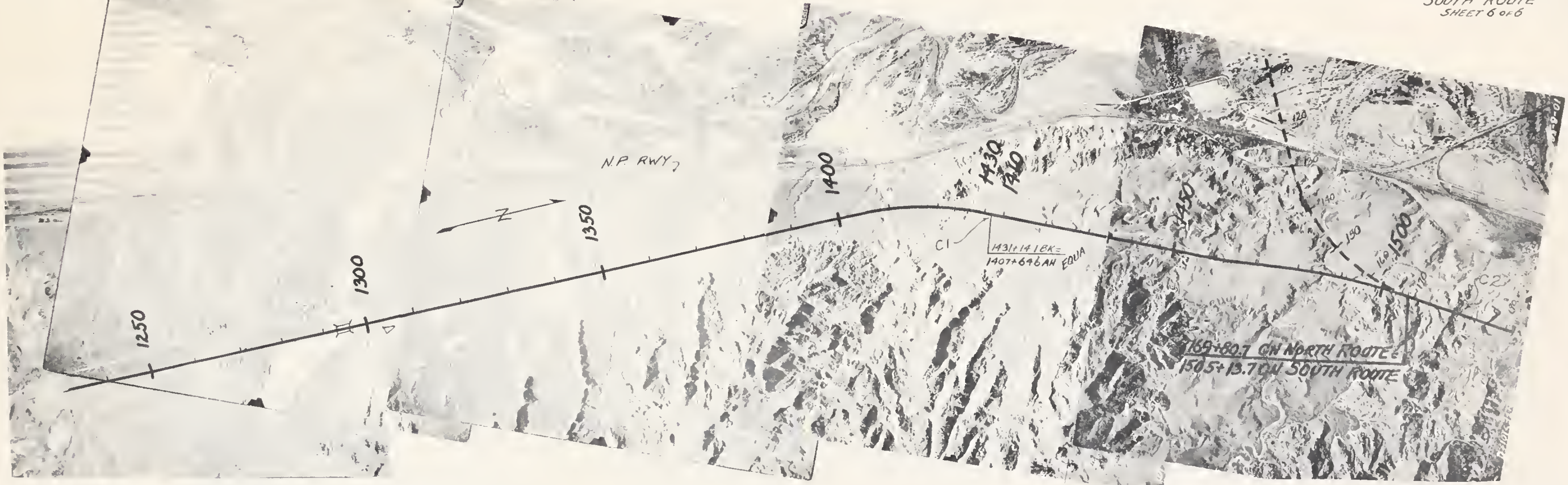
FALLON-GLENDIVE
SOUTH ROUTE
SHEET 4 of 6

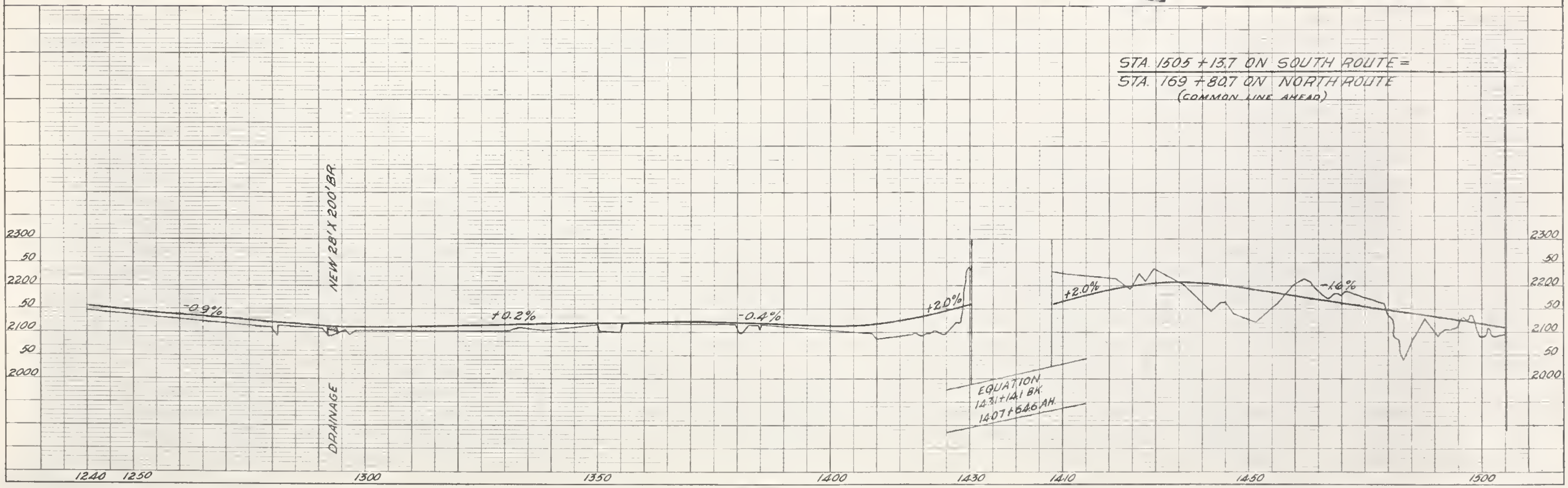




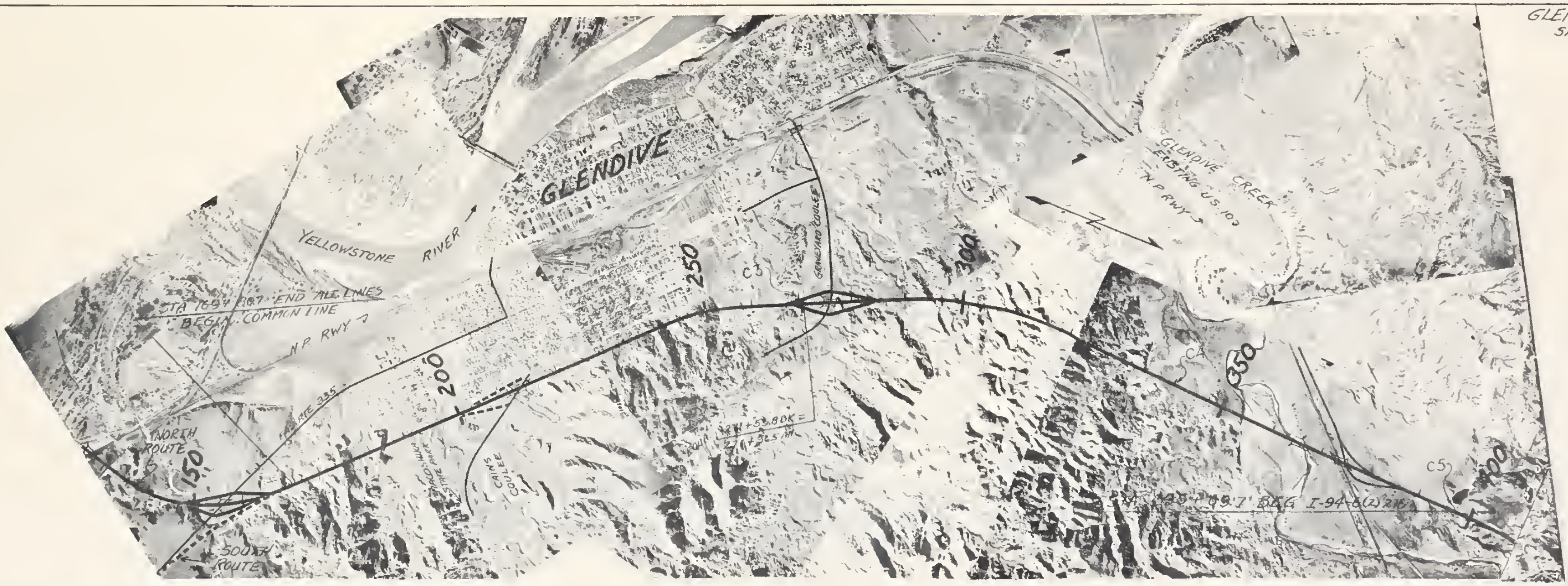

FALLON-GLENDIVE
SOUTH ROUTE
SHEET 5 OF 6
YELLOWSTONE RIVER
CEDAR CREEK
N.P. RWY.
OIL PIPE LINE
FAS RTE. 335
S7
N
950
1000
1050
1100
1150
1200
1250
END 4-LANES
BEG. 2-LANES
NEW DBL. 28'X 260' BRS.
NEW DBL. 38'X 120' BRS.
NEW 28'X 280' BR.
+4.0%
-5.0%
+4.0%
+5.0%
-5.0%
+2.0%
-1.7%
CEDAR CREEK
LOCAL ROAD SEPARATION
FAS RTE. 335 INTERCHANGE
2500
50
2400
50
2300
50
2200
50
2100
50
2000
940
950
1000
1050
1100
1150
1200
1240

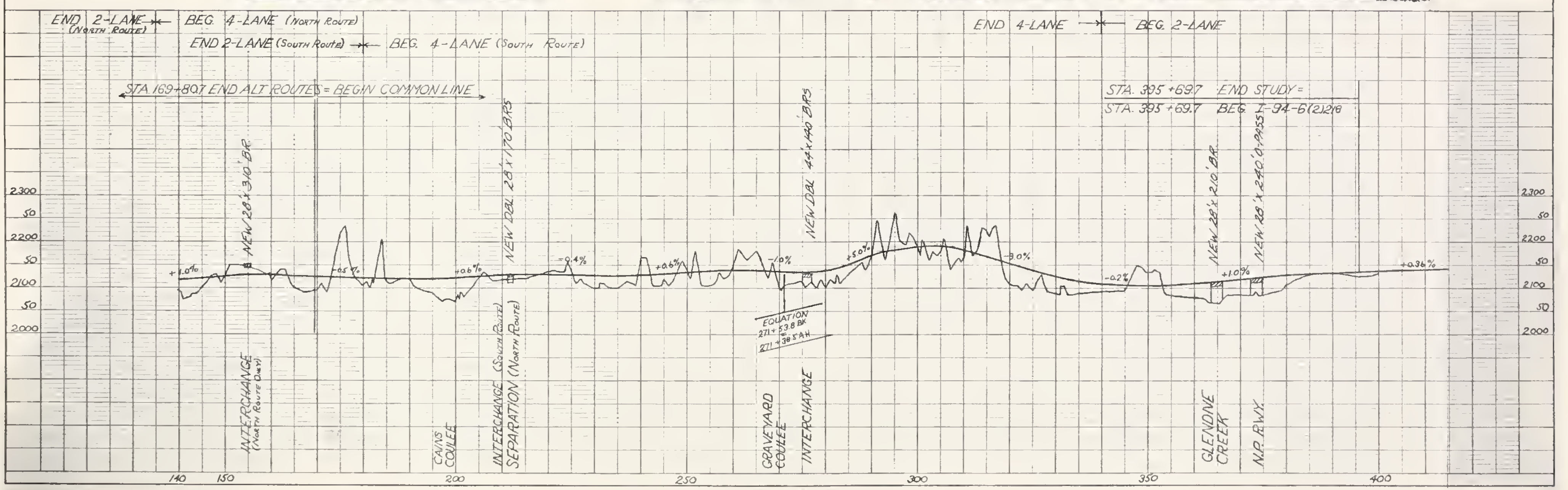
FALLON GLENDIVE
SOUTH ROUTE
SHEET 6 OF 6



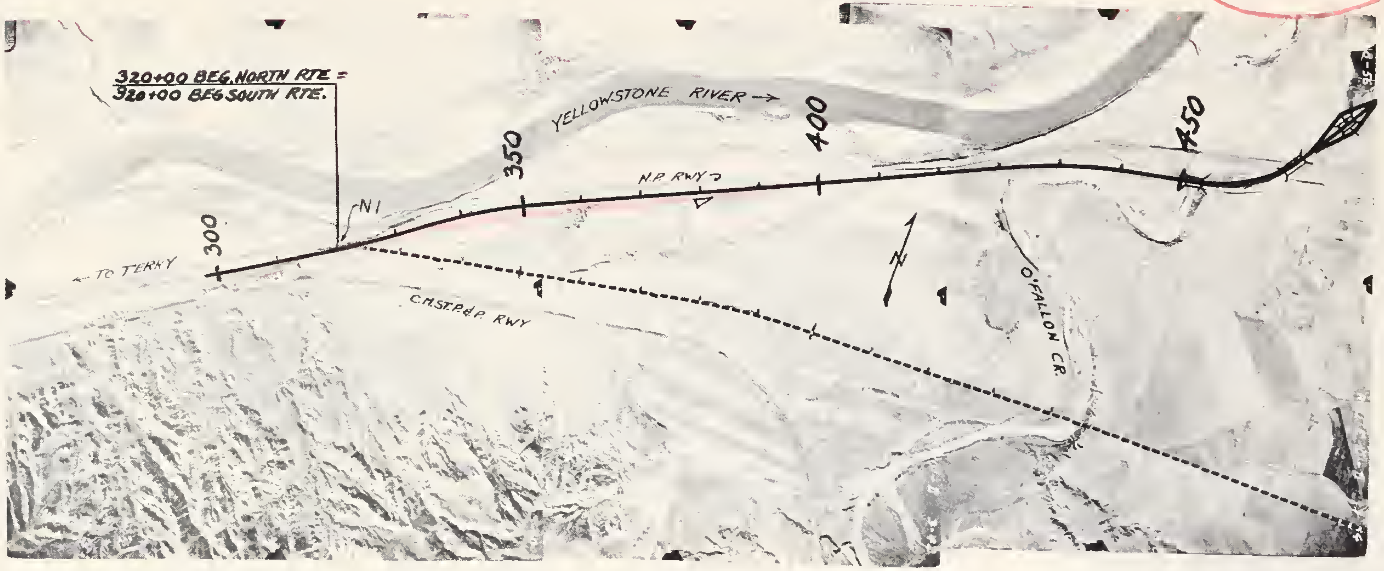


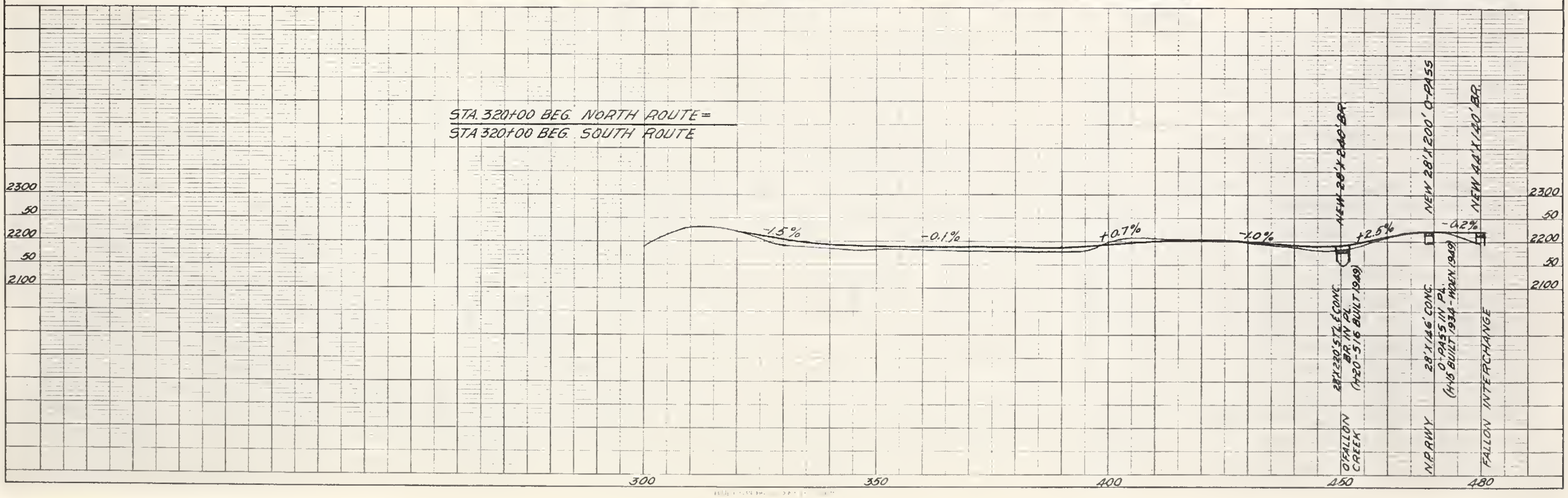
GLENDIVE URBAN
SHEET 1 OF 1

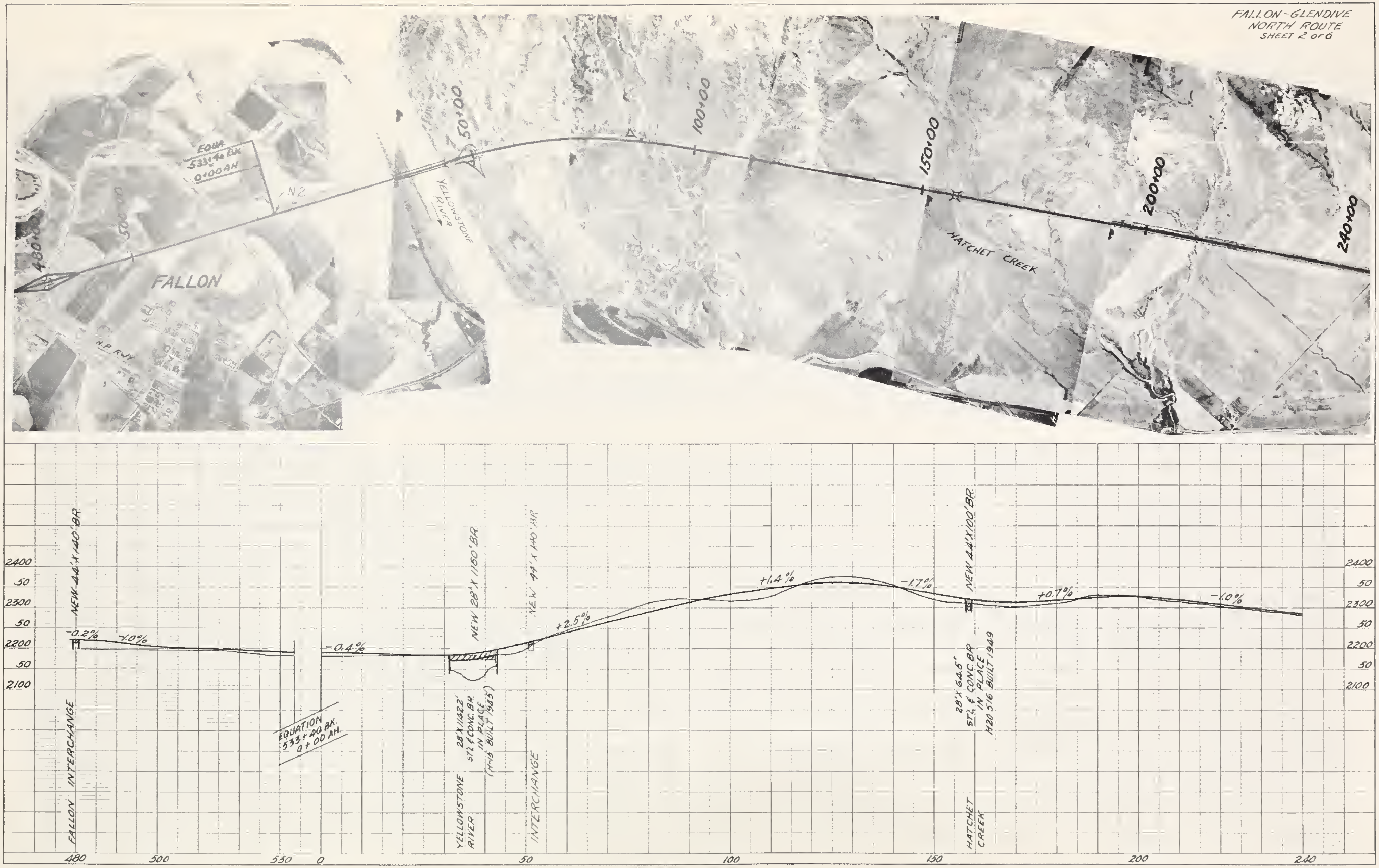




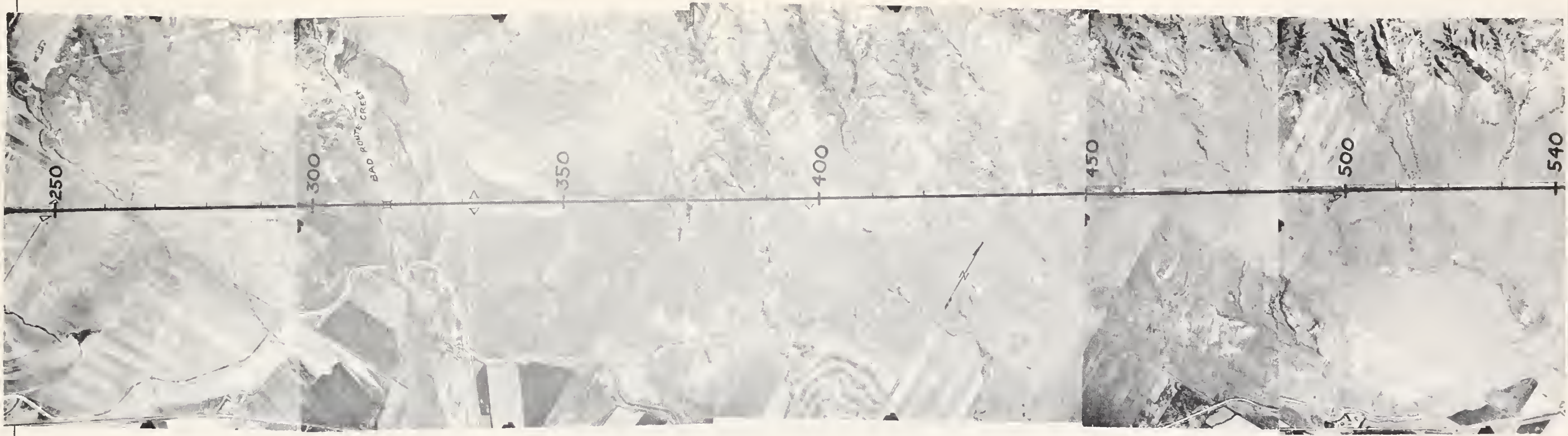
FALLON - GLENDIVE
NORTH ROUTE
SHEET 1 OF 6

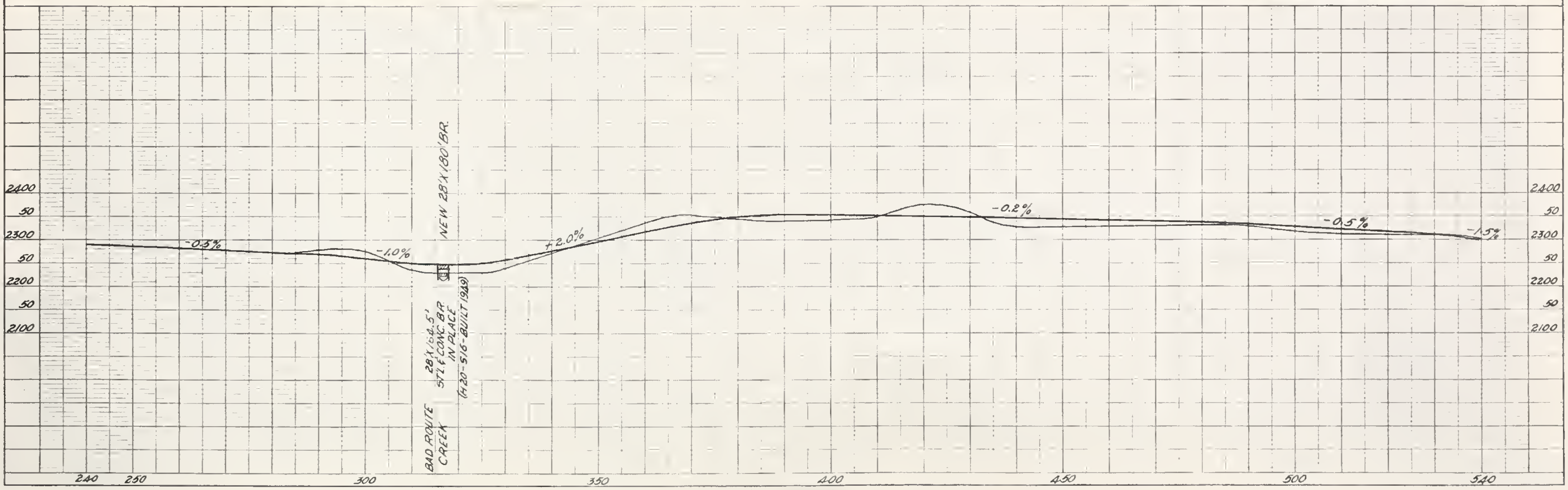





FALLON-GLENDIVE
NORTH ROUTE
SHEET 2 OF 6

FALLON-GLENDIVE
NORTH ROUTE
SHEET 3 OF 6





FALLON-GLENDIVE
NORTH ROUTE
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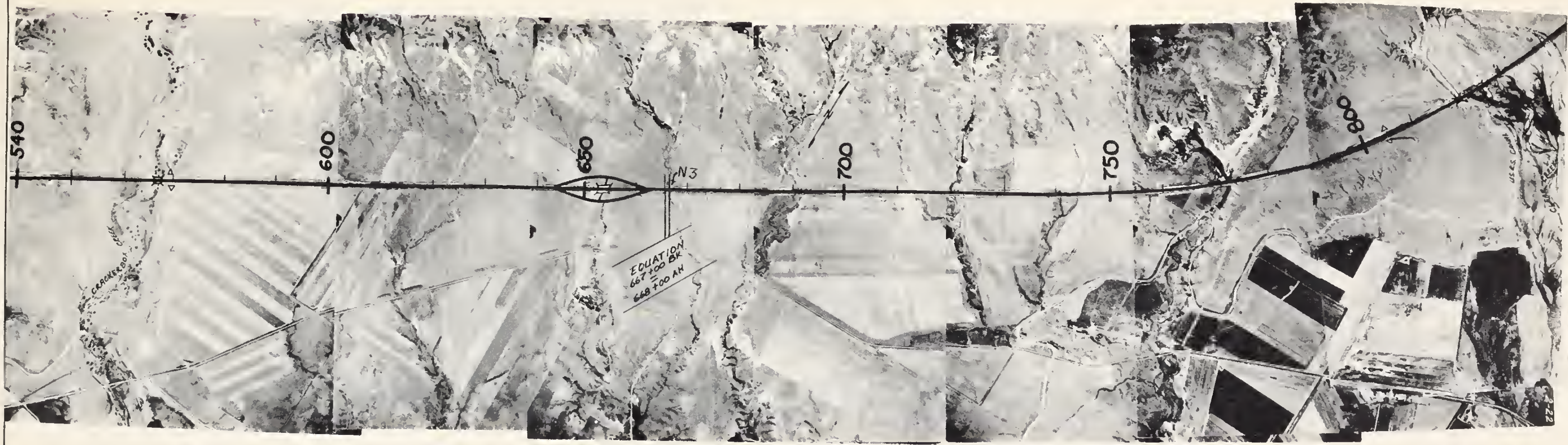

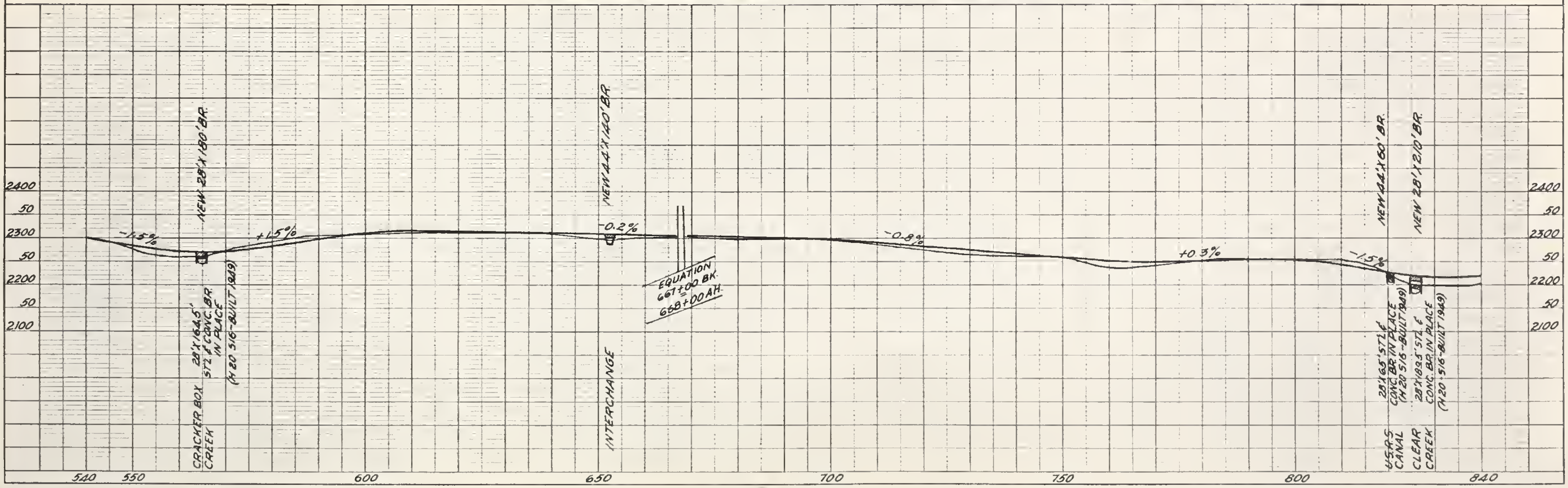

FALLON - GLENDIVE
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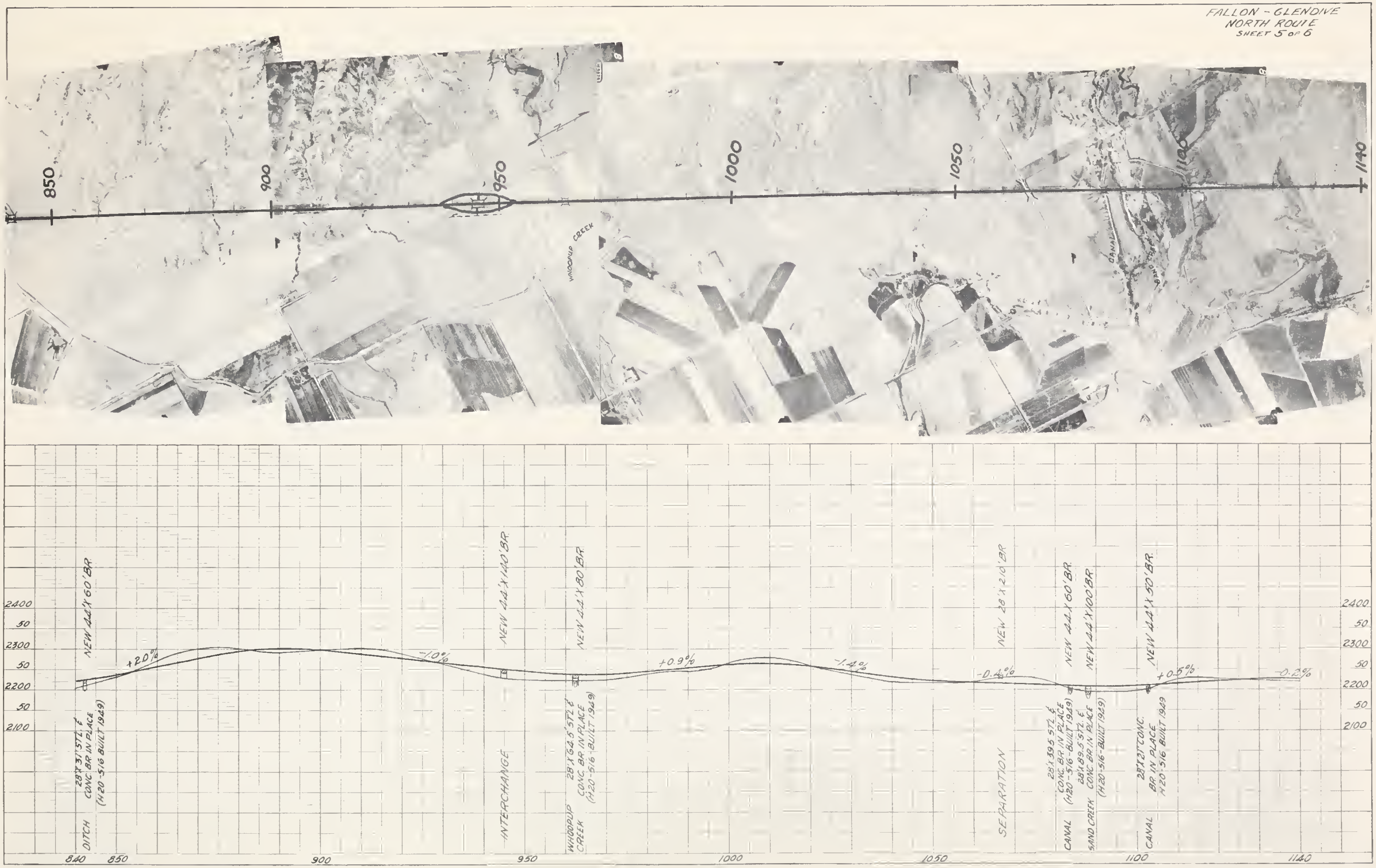
SHEET 5 of 6



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